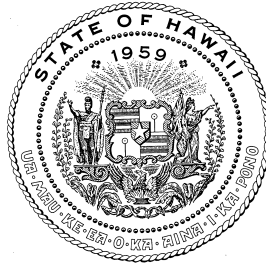


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**STATE OF HAWAII
DEPARTMENT OF HEALTH
CLEAN AIR BRANCH**



**2003
Annual Summary
Hawaii Air Quality Data**

2003
HAWAII AIR QUALITY DATA

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Section 1

INTRODUCTION



Monitors at the Honolulu station

The Department of Health, Clean Air Branch, monitors the ambient air in the State of Hawaii for various gaseous and particulate air pollutants. The U. S. Environmental Protection Agency (EPA) has set national ambient air quality standards (NAAQS) for six criteria pollutants: carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, ozone, and particulate matter (PM₁₀ and PM_{2.5}). Hawaii has also established a state ambient air standard for hydrogen sulfide. The primary purpose of the statewide monitoring network is to measure ambient air concentrations of these pollutants and ensure that these air quality standards are met.

Air pollution is caused by many different man-made and natural sources. There are industrial sources of pollution, such as power plants and refineries; mobile sources, such as cars, trucks, and buses; agricultural sources, such as cane burning; and natural sources, such as windblown dust and volcanic activity. In 2003, the state maintained 17 air monitoring stations on 4 islands. Most commercial, industrial, and transportation activities and their associated air quality effects occur on Oahu, where 10 of the stations are located. Maui and Kauai each have one monitoring station, mainly to measure the air quality impacts from agricultural activities. The ongoing eruption of the Kilauea Volcano and air quality impacts associated with geothermal energy production are being monitored at five stations on the island of Hawaii. Current plans are to continue sampling at these sites; however, relocations, additions and/or discontinuations can occur in the future as the need arises.

This report summarizes the validated air pollutant data collected at the 17 monitoring stations during calendar year 2003. Tabular summaries are provided which compare the measured concentrations with federal ambient air quality standards. Trend summaries of pollutants that have at least five years of data are depicted graphically.

The Department of Health also has a web site that displays near real-time air quality data from specific monitoring stations on Oahu and the Big Island. Data is posted approximately three hours after collection and is updated throughout the day. The data has not been reviewed for quality assurance and is subject to change but provides the public with viewing access to current air pollutant and meteorological information. To view this data online, go to www.hawaii.gov/health/environmental/air/cab/index.html and link to "View the Online Air Quality Data."

To view this entire book as well as books from 2001 and 2002 online, go to:
www.hawaii.gov/health/environmental/air/cab/index.html and link to "Hawaii Air Quality Data Book."

Questions or comments regarding data in this report and other air quality information should be addressed to:

Clean Air Branch
P.O. Box 3378
Honolulu, Hawaii 96801-3378
Phone: 808-586-4200
Fax: 808-586-4359

The Department of Health provides access to its programs and activities without regard to race, color, national origin (including language), age, sex, religion, or disability. Write or call our Affirmative Action Officer at Box 3378, Honolulu, HI 96801-3378 or at (808) 586-4616 (voice) within 180 days of a problem.

Section 2

DEFINITIONS



Kapolei Monitoring station

“Ambient Air”: The general outdoor atmosphere, external to buildings, to which the general public has access.

“Ambient Air Quality”: The quality or state of purity of the ambient air.

“Ambient Air Quality Standard”: A limit in the quantity and exposure to pollutants dispersed or suspended in the ambient air. Primary standards are set to protect public health, including sensitive populations such as asthmatics, children, and the elderly. Secondary standards are set to protect public welfare including protection against visibility degradation, and damage to animals, crops, vegetation and buildings.

“Carbon Monoxide”: Carbon monoxide (CO) is a colorless, odorless, tasteless gas under atmospheric conditions. It is produced by the incomplete combustion of carbon fuels with the majority of emissions coming from transportation sources.

“Collocated”: Procedure required for a certain percentage of PM₁₀ and PM_{2.5} samplers in the monitoring network. Collocated samplers determine precision or variation in the PM₁₀ or PM_{2.5} concentration measurements of identical samplers run in the same location under the same sampling conditions.

“EPA”: The United States Environmental Protection Agency. A federal agency established to protect human health and the natural environment.

“Hydrogen Sulfide”: Hydrogen sulfide (H₂S) is a toxic, colorless gas with a characteristic “rotten egg” odor detectable at very low levels. Also known as sewer gas, it is naturally occurring from sources such as volcanic activity, geothermal energy exploration and bacterial decomposition of organic matter.

- “ $\mu\text{g}/\text{m}^3$ ”: Micrograms per cubic meter. This is the measurement of air quality expressed as mass per unit volume.
- “NAAQS”: National Ambient Air Quality Standards. These are pollutant standards that the EPA has established to protect public health and welfare. NAAQS have been set for carbon monoxide, nitrogen dioxide, PM_{10} , $\text{PM}_{2.5}$, ozone, sulfur dioxide, and lead. These are commonly referred to as criteria pollutants.
- “NAMS”: National Air Monitoring Stations. A subset of the SLAMS network, these sites are used to track trends in certain pollutants and must meet more stringent siting requirements, equipment type, and quality assurance criteria.
- “Nitrogen Dioxide”: Nitrogen dioxide (NO_2) is a brownish, highly corrosive gas with a pungent odor. It is formed in the atmosphere from emissions of nitrogen oxides (NO_x). Sources of nitrogen oxides include electric utilities, industrial boilers, motor vehicle exhaust and combustion of fossil fuels. NO_2 is also a component in the atmospheric reaction that produces ground-level ozone.
- “Ozone”: This is the main constituent in photochemical air pollution. It is formed in the atmosphere by a chemical reaction of nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight. In the upper atmosphere, ozone (O_3) shields the earth from harmful ultraviolet radiation; however, at ground level, it can cause harmful effects in humans and plants.
- “Particulate Matter”: Any dispersed matter, solid or liquid, in which the individual aggregates are larger than the single molecules in diameter, but smaller than 500 microns. Particulate matter includes dust, soot, smoke, and liquid droplets from sources such as factories, power plants, motor vehicles, construction activities, agricultural activities, and fires.
- “ PM_{10} ”: Particulate matter that is 10 microns or less in aerodynamic diameter. These are considered “coarse” particles generally from sources such as road and windblown dust, and crushing and grinding operations.
- “ $\text{PM}_{2.5}$ ”: Particulate matter that is 2.5 microns or less in aerodynamic diameter. Considered “fine” particles, these are generally a result of fuel combustion such as from motor vehicles, utility generation and industrial facilities. Fine particles can also be formed when gases, such as SO_2 and NO_2 , are chemically transformed into particles.

“SLAMS” State and Local Air Monitoring Stations. The Clean Air Act requires that every state establish a network of air monitoring stations for criteria pollutants, using requirements set by the EPA Office of Air Quality Planning and Standards.

“Sulfur Dioxide”: Sulfur dioxide is a colorless gas that easily combines with water vapor forming sulfuric acid. When sulfur dioxide mixes with atmospheric moisture the result is commonly known as acid rain. Emissions of sulfur dioxide are largely from sources that burn fossil fuels such as coal and oil. In Hawaii, another major source of sulfur dioxide emissions is from the eruption of Kilauea Volcano on the Big Island.

“Vog”: Vog is a local term used when volcanic gas and particles combine with air and sunlight to produce atmospheric haze.

Table 2-1 State of Hawaii and Federal Ambient Air Quality Standards

Air Pollutant	Averaging Time ^a	Standards		
		Hawaii State Standard ^b ($\mu\text{g}/\text{m}^3$)	Federal Primary Standard ^c ($\mu\text{g}/\text{m}^3$)	Federal Secondary Standard ^d ($\mu\text{g}/\text{m}^3$)
Carbon Monoxide	1-hour	10,000	40,000	40,000
	8-hour	5,000	10,000	10,000
Nitrogen Dioxide	Annual	70	100	100
PM ₁₀	24-hour	150	150	150
	Annual	50	50	50
PM _{2.5}	24-hour	---	65	65
	Annual	---	15	15
Ozone	1-hour	---	235	235
	8-hour	157	157	157
Sulfur Dioxide	3-hour	1,300	---	1,300
	24-hour	365	365	---
	Annual	80	80	---
Lead ^e	Calendar Quarter	1.5	1.5	1.5
Hydrogen Sulfide	1-hour	35	—	---

^a All averaging times are based on block averages except for the 8-hour ozone and the 8-hour CO standards, which are based on running 8-hour periods

^b Designated to protect public health and welfare and to prevent the significant deterioration of air quality. *Source: HAR §11-59-1*

^c Designated to prevent against adverse effects on public health. *Source: 40CFR Part 50*

^d Designated to prevent against adverse effects on public welfare, including effects on comfort, visibility, vegetation, animals, aesthetic values, and soiling and deterioration of materials. *Source: 40CFR Part 50*

^e Ambient air monitoring for lead was discontinued in October 1997 with EPA approval. Levels in the state were far below the federal standard since sampling began. With the elimination of lead in gasoline, measured levels were consistently zero or nearly zero.

Section 3

SITE LOCATIONS AND DESCRIPTIONS



Monitors at the Pearl City station

This section provides detailed descriptions of the monitoring stations in the State of Hawaii. Table 3-1 lists the air pollutant(s) measured at each monitoring station, characterizes the area surrounding the station, and indicates the start dates for air monitoring at the station. Table 3-2 identifies the type of sampler used to measure the concentration of each air pollutant. Figures 3-1, 3-2, 3-3 and 3-4 are maps showing the location of each monitoring station on the islands of Oahu, Kauai, Maui and Hawaii, respectively.

Coordinates for each station were collected using a carrier phase global positioning system (GPS) with a mapping accuracy of approximately one meter.

ISLAND OF OAHU

1. Honolulu: Located on the roof of the Department of Health building at 1250 Punchbowl Street in downtown Honolulu, this site is in a commercial, institutional, and residential area. Originally established in 1960, this is now a SLAMS PM_{2.5}, and SO₂ station and a NAMS PM₁₀ and CO site. The coordinates are 21°18'27.27098" N latitude and 157°51'19.52241" W longitude, altitude is 20 meters above Mean Sea Level.

2. Pearl City: Located atop the Leeward Medical Center at 860 Fourth Street, the area has a combination of commercial, industrial and residential units and is approximately nine and a half miles northwest of downtown Honolulu. This site was established in 1980 and is currently a NAMS PM₁₀ and a SLAMS PM_{2.5} station. The coordinates are 21°23'34.19856" N latitude and 157°58'08.85360" W longitude, altitude is 23.12 meters above Mean Sea Level.

3. Waimanalo: Located within the Waimanalo Sewage Treatment Facility at 41-1069 Kalanianaʻole Highway, this site is in a rural agricultural community. Waimanalo is on the windward (upwind) side of Oahu approximately ten miles east-northeast of downtown Honolulu. This site was first established in 1972 and is now a SLAMS site

sampling for PM₁₀. The coordinates are 21°20'16.21667" N latitude and 157°42'16.6539" W longitude, altitude is 6.65 meters above Mean Sea Level.

4. Sand Island: Located at the University of Hawaii's Anuenue Fisheries in the Sand Island Industrial Park, the area is composed of light industrial, commercial, recreational, and harbor units and is approximately two miles southwest (typically downwind) of downtown Honolulu. Established in 1980, this is an ozone NAMS station and a PM_{2.5} SLAMS station. The coordinates are 21°18'13.81750" N latitude and 157°52'16.21590" W longitude, altitude is 5.27 meters above Mean Sea Level.

5. University: This station is located in the University Square building at 2617 South King Street. Bordered by South King Street and University Avenue, this station is in a largely commercial area with shopping centers, restaurants and shops and is in the vicinity of the University of Hawaii. Established in November 2002, this SLAMS station monitors for CO. The coordinates are 21°17'29.66208" N latitude and 157°49'17.37281" W longitude, altitude is 4.68 meters above Mean Sea Level.

6. Waikiki: Located at 2131 Kalakaua Avenue, Waikiki is a commercial and residential area with vehicular and pedestrian traffic. It is approximately three miles southeast of downtown Honolulu. The station was established in 1980 as a NAMS site for the sampling of CO. The coordinates are 21°16'53.86923" N latitude and 157°49'50.70880" W longitude, altitude is 1.36 meters above Mean Sea Level.

7. Liliha: Located at Kauluwela Elementary School, 1486 Aala Street, this site is in a residential and commercial area downwind of the heavily traveled H-1 freeway, approximately one and a quarter miles north of downtown Honolulu. This NAMS station was established in January 1984 and monitors for PM₁₀. The coordinates are 21°19'08.57706" N latitude and 157°51'31.84786" W longitude, altitude is 17.87 meters above Mean Sea Level.

8. Makaiwa: Located at 92-670 Farrington Highway, this site is in a residential, industrial and agricultural area approximately twenty-five miles west of downtown Honolulu. This station is approximately one mile to the southeast of Hawaiian Electric Company's Kahe power plant. This site was established in July 1989 as a SLAMS station monitoring for SO₂. The coordinates are 21°20'39.36299" N latitude and 158°06'46.67939" W longitude, altitude is 50.9 meters above Mean Sea Level.

9. West Beach: Located within the Ko'Olina Golf Course, this site is in a resort, recreational, and residential area approximately 27 miles west of downtown Honolulu and 1.5 miles northwest of Campbell Industrial Park. This SLAMS station was established in February 1991 and monitors for NO₂, PM₁₀, and SO₂. The coordinates are 21°19'57.87475" N latitude and 158°06'50.86663" W longitude, altitude is 14.54 meters above Mean Sea Level.

10. Kapolei: This station is located at 2052 Lauwiliwili Street in the Kapolei Business Park near the entrance to Campbell Industrial Park. It is in a commercial and industrial area with nearby residential and agricultural lands. It is approximately 25 miles west of downtown Honolulu, originally established in February 1991 as a SLAMS site monitoring for NO₂, PM₁₀, PM_{2.5}, CO and SO₂. The coordinates are 21°19'25.48126" N latitude and 158°05'19.00562" W longitude, altitude is 17.92 meters above Mean Sea Level.

ISLAND OF KAUAI

Lihue: This monitoring station is located in downtown Lihue at the District Health Office, 3034 Umi Street. This site is in a commercial and residential area with nearby agricultural areas. It is a SLAMS station that was established in January 1972 and samples for PM₁₀. The coordinates are 21°58'28.84947" N latitude and 159°21'58.09671" W longitude, altitude is 71.08 meters above Mean Sea Level.

ISLAND OF MAUI

Kihei: This station is located in Upper Kihei at Hale Piilani Park. Monitoring for particulates from sugarcane burning activities has been conducted in the Kihei area since 1996. In February 1999, the station was moved to Hale Piilani Park, which is in a residential and agricultural area, and monitors for PM₁₀ and PM_{2.5}. The coordinates are 20°46'51.58844" N latitude and 156°26'46.94337" W longitude, altitude is 46.52 meters above Mean Sea Level.

ISLAND OF HAWAII

1. Kona: This station is located on the grounds of the Konawaena High School at 81-1043 Konawaena School Road in Kealahou, Hawaii. This special purpose monitoring station was established in April 1997 to monitor for vog in the Kona area. The pollutant sampled at this site is SO₂. The coordinates are 19°30'27.83302" N latitude and 155°55'03.67861" W longitude, altitude is 479.61 meters above Mean Sea Level.

2. Hilo: Established in March 1995, this special purpose monitoring station for vog is located on the grounds of the Adult Rehabilitation Center of Hilo at 1099 Waianuenue Avenue. The pollutants sampled are SO₂ and PM₁₀. The coordinates are 19°43'03.22398" N latitude and 155°06'37.90606" W longitude, altitude is 136.76 meters above Mean Sea Level.

3. Lava Tree: This station in Puna is located on the eastern border of the Lava Tree State Park in a residential and agricultural area near Nanawale Estates. It is approximately 1.4 miles northwest of the Puna Geothermal Venture power plant. The station was established in August 1993 and monitors for H₂S. The coordinates are 19°29'11.06393" N latitude and 154°54'11.22523" W longitude, altitude is 192.65 meters above Mean Sea Level.

4. Puna E: Located in the Leilani Estates residential subdivision in Puna, it is approximately 1.5 miles southwest of the Puna Geothermal Venture power plant. Established in 1992, this station monitors for H₂S. The coordinates are 19°27'50.3594" N latitude and 154°53'55.34089" W longitude, altitude is 207.86 meters above Mean Sea Level.

5. Puna H: This H₂S monitoring station was established in November 2002 and is located in the Lanipuna Gardens subdivision in Puna. It is approximately one-half mile south-southwest from the Puna Geothermal Venture power plant. The GPS coordinates for this station were not available at the time of publication.

Table 3-1 State of Hawaii Air Monitoring Network

	Station Type								
SITE	PM₁₀	PM_{2.5}	CO	O₃	SO₂	NO₂	H₂S	SITE DESCRIPTION	ESTABLISHED
OAHU									
Honolulu	N	S, C	N	-	S	-	-	Center City / Commercial	January 1960
Pearl City	N	S, C	-	-	-	-	-	Center City / Residential	July 1980
Waimanalo	S	-	-	-	-	-	-	Rural / Agricultural	January 1972
Sand Island	-	S	-	N	-	-	-	Center City / Commercial	January 1980
Waikiki	-	-	N	-	-	-	-	Center City / Commercial	November 1980
University	-	-	S	-	-	-	-	Center City / Commercial	November 2002
Liliha	N	-	-	-	-	-	-	Center City / Mobile	January 1984
Makaiwa	-	-	-	-	S	-	-	Rural / Industrial	July 1989
West Beach	S, C	-	-	-	S	S	-	Rural / Commercial	February 1991
Kapolei	S	S	S	-	S	S	-	Rural / Industrial	February 1991
KAUAI									
Lihue	S	-	-	-	-	-	-	Center City / Commercial	January 1972
MAUI									
Kihei	SPM	S	-	-	-	-	-	Suburban / Residential	February 1999
HAWAII									
Kona	-	-	-	-	SPM	-	-	Suburban	April 1997
Hilo	SPM	-	-	-	SPM	-	-	Center City	March 1995
Lava Tree	-	-	-	-	-	-	SPM	Rural / Agricultural	August 1993
Puna E	-	-	-	-	-	-	SPM	Rural / Agricultural	1992
Puna H	-	-	-	-	-	-	SPM	Rural / Agricultural	November 2002

N = (NAMS) National Air Monitoring Station

C = Collocated Site

S = (SLAMS) State and Local Air Monitoring Station

SPM = Special Purpose Monitoring Station, (for monitoring vog, or geothermal energy production)

Table 3-2 Sampling Equipment at Each Monitoring Station

Monitoring Station	Sampling Method							
	PM ₁₀ Continuous Ambient Particulate Monitor	PM ₁₀ Manual Ambient Particulate Monitor (1 in 6 days)	PM _{2.5} Manual Ambient Particulate Monitor	CO Continuous Gas Filter Correlation Analyzer	SO ₂ Continuous Pulsed Fluorescence Ambient Air Analyzer	O ₃ Continuous UV Photometric Analyzer	NO ₂ Continuous Chemiluminescence Analyzer	H ₂ S Continuous Pulsed Fluorescence Ambient Air Analyzer
OAHU								
Honolulu	✓		✓ (daily)	✓	✓			
Pearl City	✓		✓ (daily)					
Waimanalo		✓						
Sand Island			✓ (1 in 6 days)			✓		
Waikiki				✓				
University				✓				
Liliha	✓							
Makaiwa					✓			
West Beach		✓			✓		✓	
Kapolei	✓		✓ (1 in 3 days)	✓	✓		✓	
KAUAI								
Lihue		✓						
MAUI								
Kihei	✓		✓ (1 in 3 days)					
HAWAII								
Kona					✓			
Hilo		✓			✓			
Lava Tree								✓
Puna E								✓
Puna H								✓

Figure 3-1: Island of Oahu - Air Quality Monitoring Stations

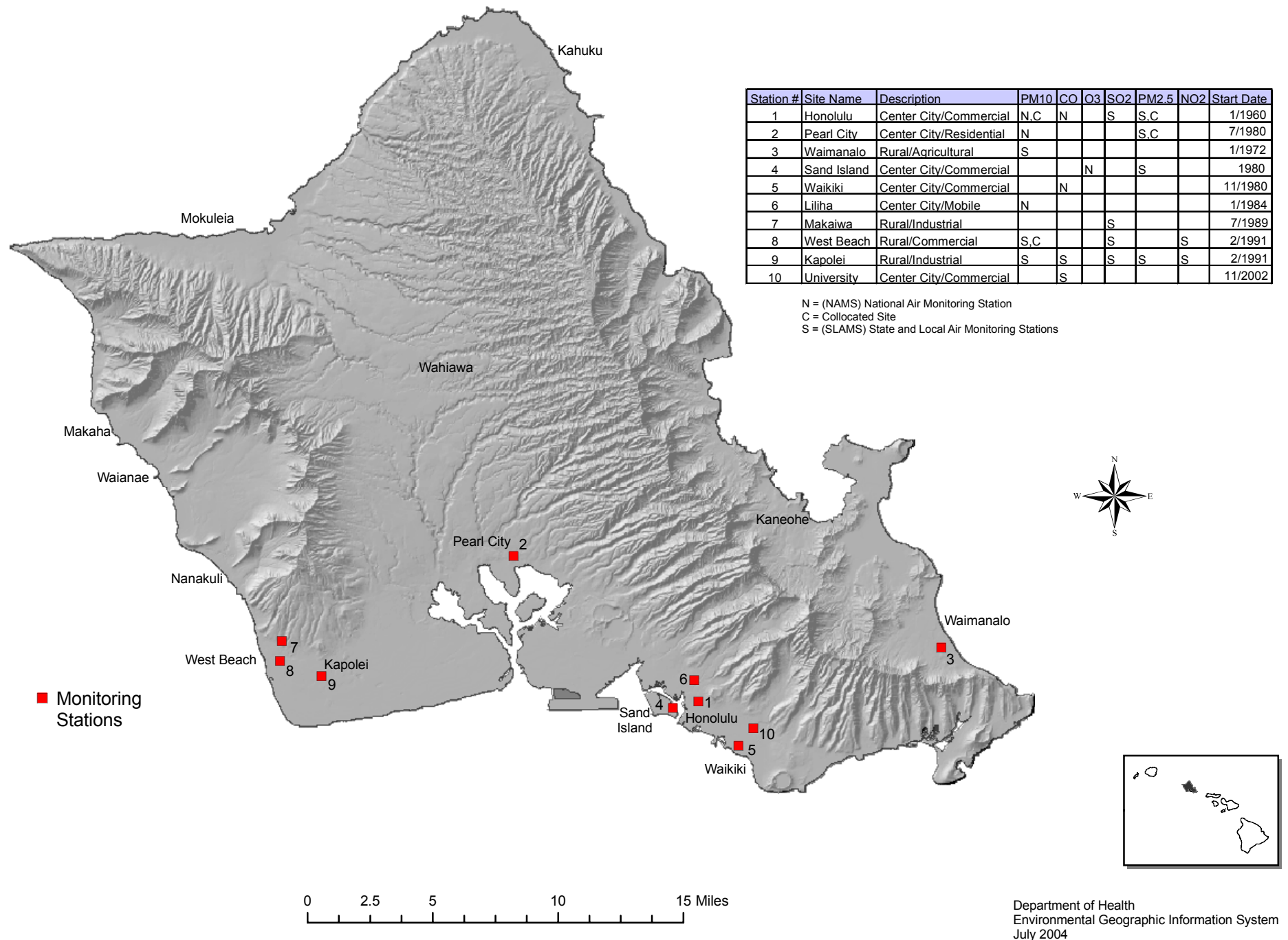


Figure 3-2: Island of Kauai - Air Quality Monitoring Stations

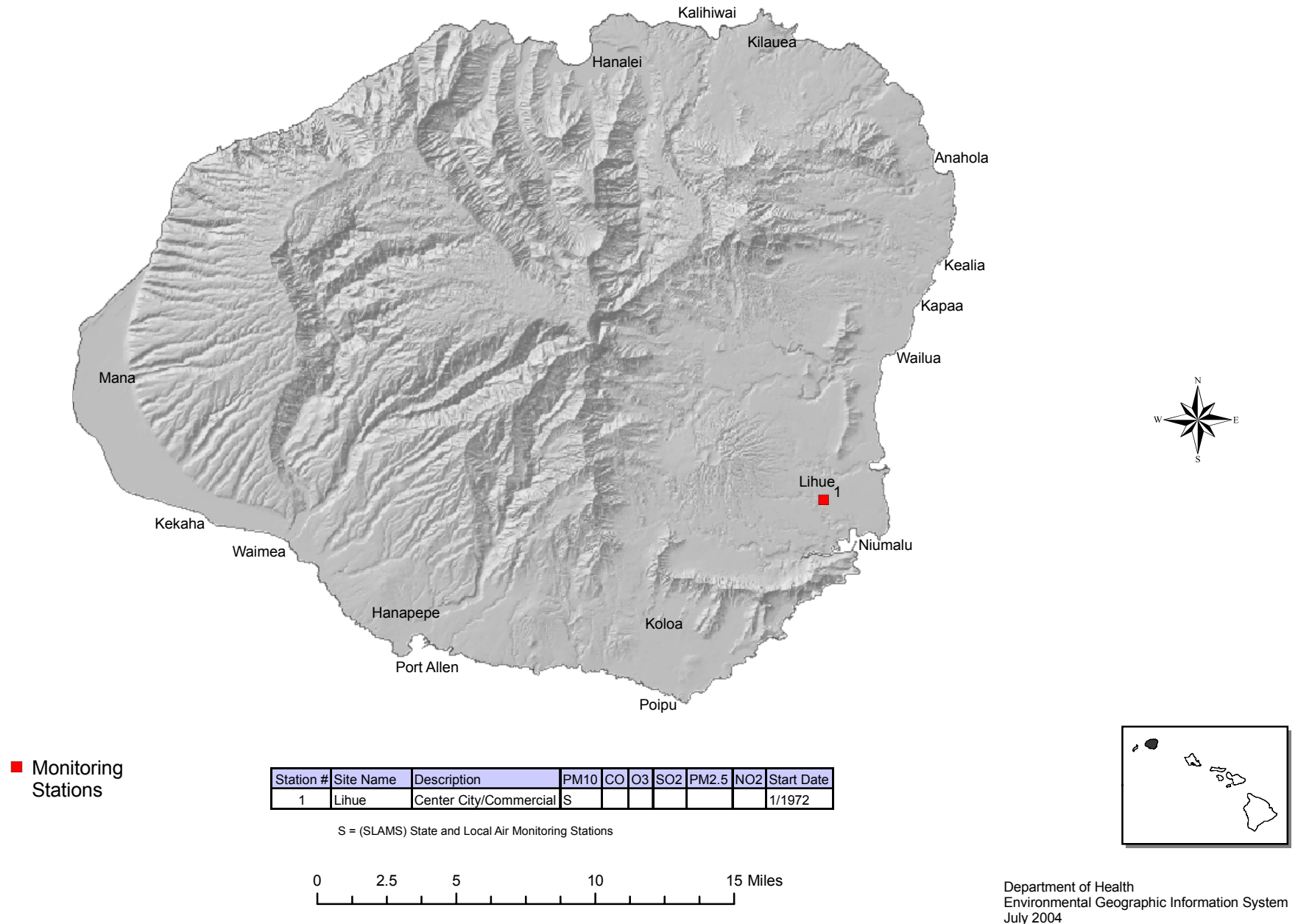


Figure 3-3: Island of Maui - Air Quality Monitoring Stations

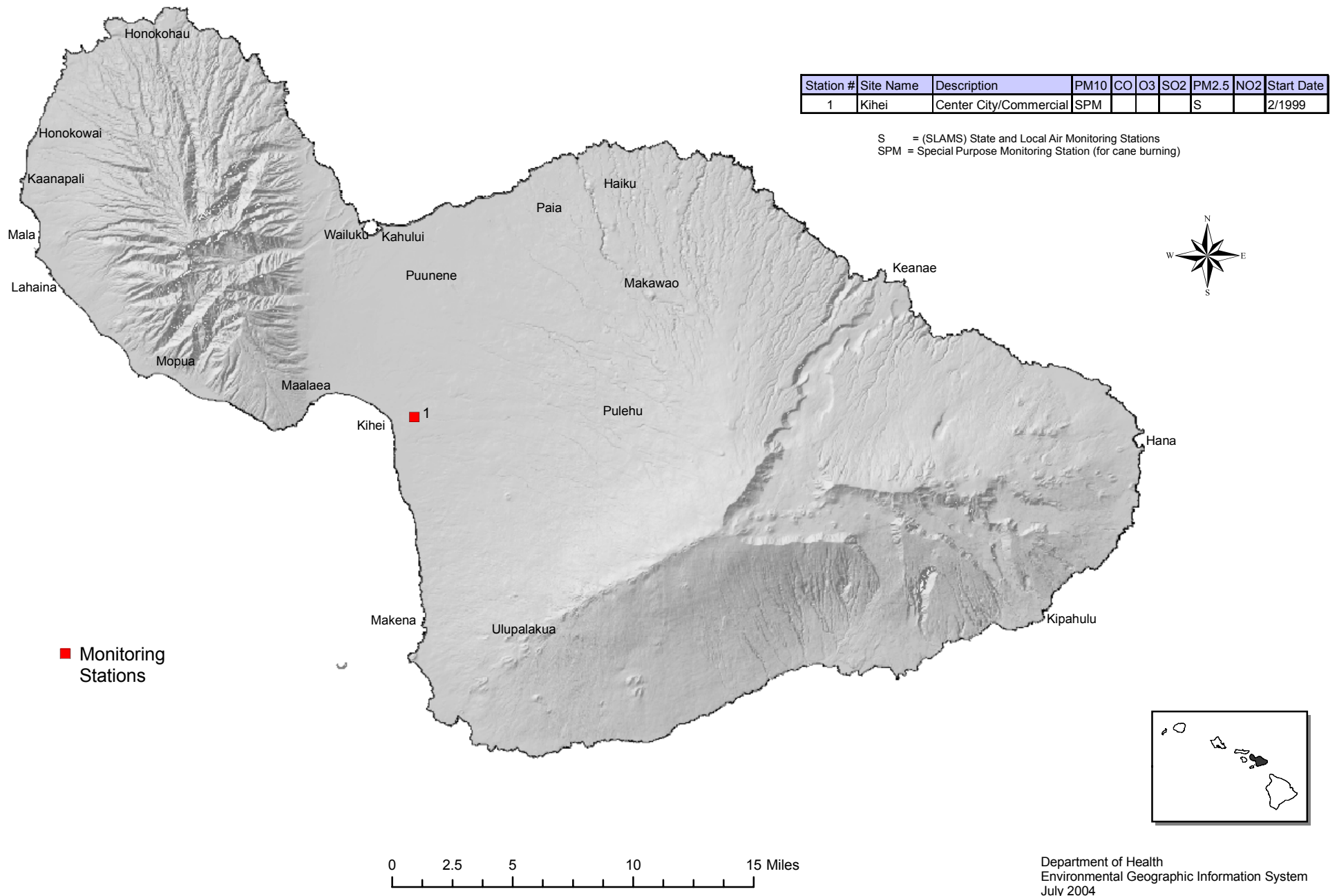
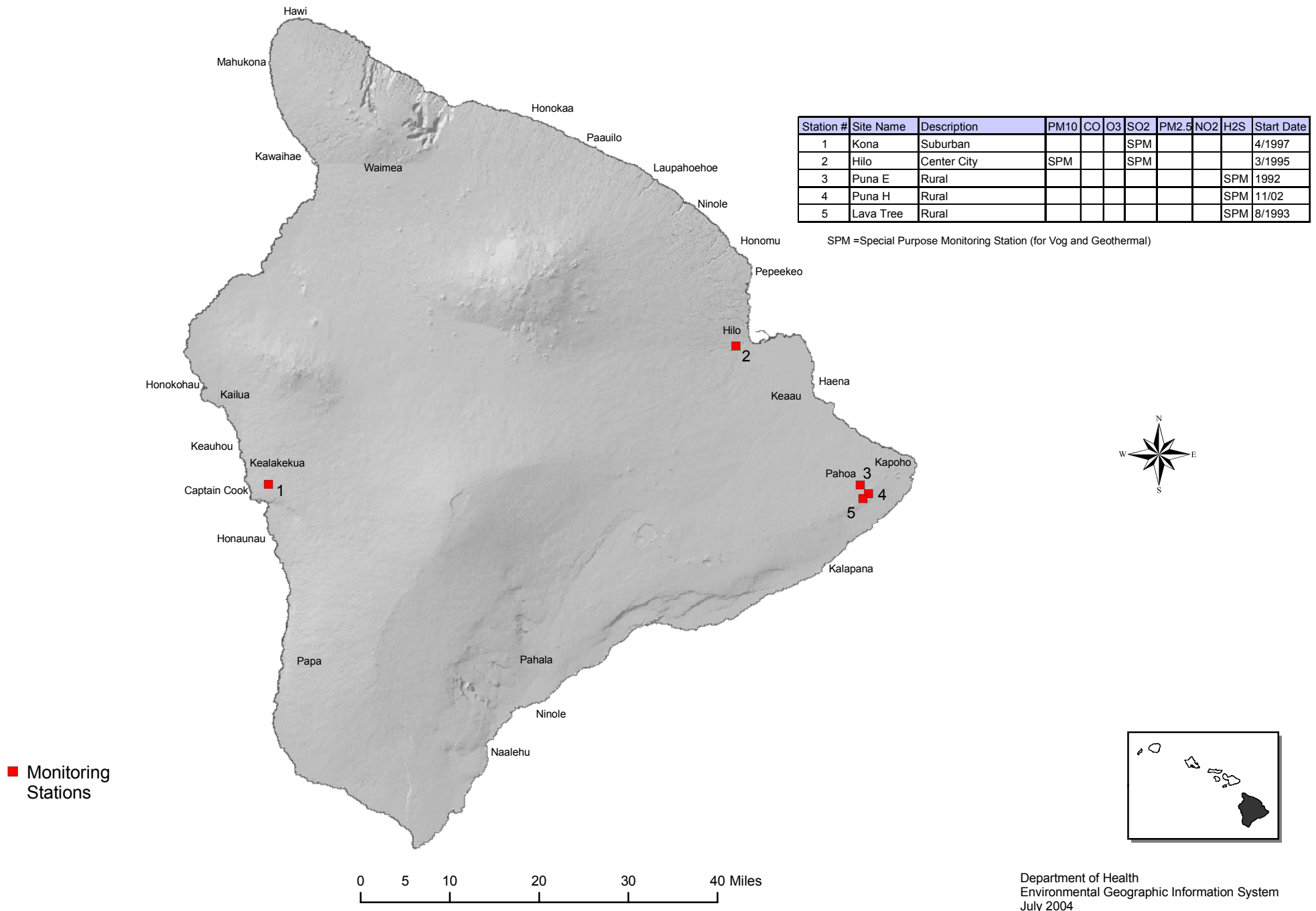


Figure 3-4: Island of Hawaii - Air Quality Monitoring Stations



Section 4

2003 AIR QUALITY DATA



West Beach station

To protect the state's air quality from degradation, the Department of Health's Clean Air Branch is responsible for regulating and monitoring pollution sources to ensure that the levels of criteria pollutants remain well below the state and federal ambient air quality standards. Data collected from the ambient air network is audited to ensure that the reported data is of good quality and meets all quality control and assurance requirements.

The following tables summarize the pollutant concentrations measured at each monitoring station. Tables 4-1 through 4-10 are annual summaries grouped by pollutant and provide the number of occurrences exceeding the NAAQS. There is no federal ambient air quality standard for H_2S , and Table 4-10 provides the number of occurrences exceeding the state standard.

The annual statistics provided in tables 4-1 through 4-10 are the highest and second highest $\mu\text{g}/\text{m}^3$ values recorded in the year for the averaging period, and the annual means, which is the arithmetic mean of all valid hours recorded in the year. The "Possible Periods" is the total number of sampling periods in the year for the averaging time, "Valid Periods" is the total number of acceptable sampling periods after data validation, and "Percent Recovery" represents the amount of quality data reported.

Tables 4-11 through 4-20 are monthly summaries of the range and average of each pollutant for each averaging period. The range is the lowest and highest $\mu\text{g}/\text{m}^3$ values recorded in the month for the averaging period and the average is the arithmetic mean of all hours recorded in the month. The month with the highest valid value recorded in the year for each site is highlighted.

In the year 2003, the State of Hawaii was in attainment for all federal ambient air quality standards.

Table 4-1 Annual Summary of 24-Hour PM₁₀

	Annual Statistics																	
	Maximum		Annual Means	24-hour Occurrences Greater than 150 µg/m ³												Possible Periods	Valid Periods	Percent Recovery
	1 st High	2 nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
OAHU																		
Honolulu ^b	47/32	34/31	16/15	0	0	0	0	0	0	0	0	0	0	0	0	365	314/312	85
Liliha ^b	81/37	41/29	16	0	0	0	0	0	0	0	0	0	0	0	0	365	345/343	94
Waikiki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
University	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo ^a	31	29	17	0	0	0	0	0	0	0	0	0	0	0	0	61	61	100
Pearl City ^b	99/30	62/27	15	0	0	0	0	0	0	0	0	0	0	0	0	365	331/329	90
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei ^b	99/72	29	14	0	0	0	0	0	0	0	0	0	0	0	0	365	344/343	94
West Beach ^a	33	29	16	0	0	0	0	0	0	0	0	0	0	0	0	61	57	93
KAUAI																		
Lihue ^a	31	27	16	0	0	0	0	0	0	0	0	0	0	0	0	61	61	100
MAUI																		
Kihei	78	72	23	0	0	0	0	0	0	0	0	0	0	0	0	365	340	93
HAWAII																		
Kona	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-
Hilo ^a	20	20	12	0	0	0	0	0	0	0	0	0	0	0	0	61	61	100
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

^a PM₁₀ sampling is once every 6th day

^b The first value listed includes the New Year's fireworks data, the second value in bold is the reported valid value

Table 4-2 Annual Summary of 24-Hour PM_{2.5}

	Annual Statistics																	
	<u>Maximum</u>		<u>Annual Means</u>	<u>24-hour Occurrences Greater than 65 µg/m³</u>												Possible Periods	Valid Periods	Percent Recovery
	1 st High	2 nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
OAHU																		
Honolulu ^c	36/20	25/10	4	0	0	0	0	0	0	0	0	0	0	0	0	365	361/359	98
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waikiki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island ^a	16	12	6	0	0	0	0	0	0	0	0	0	0	0	0	61	59	97
University	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City ^c	92/13	47/13	4	0	0	0	0	0	0	0	0	0	0	0	0	365	328/326	89
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei ^b	11	9	4	0	0	0	0	0	0	0	0	0	0	0	0	121	113	93
West Beach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KAUAI																		
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																		
Kihei ^b	25	17	6	0	0	0	0	0	0	0	0	0	0	0	0	121	106	88
HAWAII																		
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

^a Sampling is once every 6 days ^b Sampling is once every 3 days ^c The first value listed includes the New Year's fireworks data, the second value in bold is the reported valid value

Table 4-3 Annual Summary of 1-Hour Carbon Monoxide

[illegible]

Table 4-4 Annual Summary of 8-Hour Carbon Monoxide

[illegible]

Table 4-5 Annual Summary of 1-Hour Ozone

[illegible]

Table 4-6 Annual Summary of 8-Hour Ozone

[illegible]

Table 4-7 Annual Summary of 3-Hour Sulfur Dioxide

[illegible]

Table 4-8 Annual Summary of 24-Hour Sulfur Dioxide

[illegible]

Table 4-9 Annual Summary of Nitrogen Dioxide

[illegible]

Table 4-10 Annual Summary of 1-Hour Hydrogen Sulfide

	Annual Statistics																	
	<u>Maximum</u>		<u>Annual Means</u>	<u>1-hour Occurrences Greater than 35 µg/m³</u>												Possible Periods	Valid Periods	Percent Recovery
	1 st High	2 nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
OAHU																		
Honolulu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waikiki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
University	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Beach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KAUAI																		
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																		
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																		
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	13	10	3	0	0	0	0	0	0	0	0	0	0	0	0	8760	8319	95
Puna E	7	6	3	0	0	0	0	0	0	0	0	0	0	0	0	8760	8143	93
Puna H	7	7	2	0	0	0	0	0	0	0	0	0	0	0	0	8760	8220	94

Table 4-11 Monthly Summary of 24-Hour PM₁₀ (µg/m³)

(The month with the highest annual value is highlighted, value due to New Year's fireworks excluded)

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	5 - 47	8 - 20	8 - 27	13 - 31	11 - 26	9 - 16	9 - 23	9 - 20	10 - 17	10 - 22	12 - 25	7 - 34
	Average	19	15	15	19	18	12	15	14	14	18	16	15
Liliha	Range	6 - 41	7 - 20	7 - 27	12 - 29	11 - 25	10 - 17	9 - 24	9 - 22	5 - 22	11 - 23	11 - 25	8 - 81
	Average	19	15	16	19	18	13	16	15	14	16	17	17
Pearl City	Range	6 - 62	7 - 21	8 - 24	12 - 30	1 - 25	9 - 16	10 - 23	9 - 22	8 - 18	10 - 21	11 - 24	8 - 99
	Average	18	14	15	18	17	13	15	15	13	14	15	17
Waimanalo (1 in 6 days)	Range	11 - 20	3 - 17	13 - 17	14 - 27	16 - 20	10 - 18	15 - 25	12 - 23	9 - 21	11 - 18	17 - 31	12 - 29
	Average	16	13	15	20	18	14	19	19	15	15	24	19
Kapolei	Range	5 - 99	6 - 20	7 - 25	10 - 28	9 - 72	8 - 15	9 - 21	8 - 19	8 - 15	9 - 20	10 - 22	6 - 40
	Average	20	13	14	17	17	11	14	13	11	14	15	14
West Beach (1 in 6 days)	Range	11 - 20	6 - 13	7 - 16	13 - 23	16 - 22	10 - 33	13 - 25	10 - 27	13 - 19	13 - 29	12 - 28	11 - 21
	Average	16	10	13	18	19	16	19	16	15	18	20	18
Lihue (1 in 6 days)	Range	5 - 17	10 - 13	8 - 20	13 - 23	13 - 17	9 - 15	12 - 26	9 - 24	9 - 17	12 - 20	17 - 31	14 - 27
	Average	12	11	13	17	15	12	16	18	13	16	24	21
Kihei	Range	6 - 29	7 - 27	8 - 26	14 - 50	16 - 72	10 - 52	14 - 71	13 - 41	12 - 55	10 - 78	11 - 47	8 - 21
	Average	15	15	16	24	33	25	29	28	24	28	22	15
Hilo (1 in 6 days)	Range	10 - 20	7 - 10	7 - 20	10 - 16	8 - 14	6 - 12	10 - 15	10 - 14	8 - 16	10 - 14	10 - 19	10 - 19
	Average	14	9	11	12	12	9	13	12	12	13	14	13

The state and federal 24-hr PM₁₀ standards are 150 µg/m³

Table 4-12 Monthly Summary of 24-Hour PM_{2.5} (µg/m³)

(The month with the highest annual value is highlighted, value due to New Year's fireworks excluded)

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu (daily)	Range	1 - 36	1 - 6	2 - 8	3 - 10	2 - 20	2 - 6	2 - 7	1 - 7	2 - 10	2 - 8	1 - 10	1 - 25
	Average	6	3	4	5	6	3	4	3	4	4	4	4
Pearl City (daily)	Range	1 - 46	2 - 5	2 - 7	2 - 9	3 - 13	2 - 7	2 - 9	1 - 8	2 - 10	2 - 7	0 - 7	1 - 92
	Average	7	3	4	5	5	4	4	4	4	4	3	7
Sand Island (1 in 6 days)	Range	6 - 9	3 - 6	3 - 5	4 - 12	6 - 16	3 - 5	3 - 7	3 - 12	2 - 8	5 - 9	4 - 8	3 - 8
	Average	8	4	4	7	9	4	5	7	4	7	6	5
Kapolei (1 in 3 days)	Range	1 - 9	1 - 3	2 - 5	2 - 5	2 - 11	1 - 9	2 - 5	2 - 5	2 - 6	2 - 7	1 - 5	0 - 5
	Average	5	2	3	4	5	4	3	3	3	4	3	5
Kihei (1 in 3 days)	Range	3 - 9	2 - 6	3 - 11	3 - 17	4 - 9	3 - 9	4 - 9	3 - 8	3 - 13	2 - 12	1 - 7	3 - 25
	Average	5	4	5	7	7	5	5	5	6	6	4	7

The federal 24-hr PM_{2.5} standard is 65 µg/m³

Table 4-13 Monthly Summary of 24-Hour Nitrogen Dioxide (µg/m³)

(The month with the highest annual value is highlighted)

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Kapolei	Range	5 - 24	5 - 14	4 - 19	3 - 14	3 - 12	3 - 17	4 - 9	5 - 12	4 - 13	5 - 18	5 - 18	7 - 19
	Average	13	9	12	6	6	9	7	7	8	10	10	11
West Beach	Range	2 - 20	4 - 14	5 - 14	4 - 18	4 - 13	5 - 18	5 - 14	0 - 13	3 - 13	2 - 15	3 - 13	4 - 15
	Average	10	7	9	7	8	8	9	5	6	7	8	8

There are no 24-hour state or federal standards for nitrogen dioxide

Table 4-14 Monthly Summary of 1-Hour Carbon Monoxide ($\mu\text{g}/\text{m}^3$)

(The month with the highest annual value is highlighted)

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	342-2508	684-2166	342-2622	570-2052	228-2052	342-1596	456-1368	228-1596	342-1254	228-2280	228-2166	342-2850
	Average	817	911	643	762	749	596	725	594	592	504	700	888
Waikiki	Range	342-2166	342-2394	342-2508	342-2394	570-4788	570-1938	570-1482	570-2166	342-2052	342-2508	342-2394	570-3420
	Average	685	613	800	778	894	938	903	850	862	789	818	961
University	Range	342-3192	342-3192	342-2736	342-2850	342-2964	342-2508	342-2052	342-2052	342-2850	342-3192	342-2508	342-3990
	Average	1137	919	953	633	726	929	843	860	1078	955	975	852
Kapolei	Range	114-2166	228-1254	342-1368	228-1026	228-1596	342-1026	114-684	228-570	114-1368	342-1026	342-1026	228-1482
	Average	388	395	493	367	383	464	324	359	351	443	527	457

The state 1-hr CO standard is $10,000 \mu\text{g}/\text{m}^3$, the federal 1-hr CO standard is $40,000 \mu\text{g}/\text{m}^3$

Table 4-15 Monthly Summary of 8-Hour Carbon Monoxide ($\mu\text{g}/\text{m}^3$)

(The month with the highest annual value is highlighted)

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	456-1511	684-1240	371-1539	570-1240	271-1226	399-955	513-1097	257-1156	385-855	257-912	242-1154	356-1539
	Average	816	910	645	760	753	597	723	597	591	500	698	889
Waikiki	Range	342-1397	342-1439	399-1433	556-1525	641-1547	684-1401	627-1254	670-1397	442-1354	371-1382	470-1525	584-1739
	Average	685	614	799	777	895	940	903	849	863	786	819	959
University	Range	342-2071	342-2651	342-1881	347-2101	342-1596	456-1726	342-1468	342-1283	342-2109	342-2038	470-1810	342-2537
	Average	1141	922	948	636	729	932	844	861	1075	953	974	848
Kapolei	Range	185-841	228-713	342-698	228-668	228-670	342-641	114-603	228-485	214-646	342-613	413-770	242-755
	Average	387	396	492	367	386	463	326	358	351	4472	526	459

The state 8-hr CO standard is $5,000 \mu\text{g}/\text{m}^3$, the federal 8-hr CO standard is $10,000 \mu\text{g}/\text{m}^3$

Table 4-16 Monthly Summary of 1-Hour Ozone ($\mu\text{g}/\text{m}^3$)

(The month with the highest annual value is highlighted)

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Sand Island	Range	0 - 92	0 - 80	0 - 75	0 - 106	2 - 75	2 - 69	0 - 53	0 - 45	0 - 57	0 - 84	0 - 69	0 - 82
	Average	41	46	36	42	36	27	21	20	26	23	34	33

The federal 1-hr O_3 standard is $235 \mu\text{g}/\text{m}^3$

Table 4-17 Monthly Summary of 8-Hour Ozone ($\mu\text{g}/\text{m}^3$)

(The month with the highest annual value is highlighted)

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Sand Island	Range	0 - 77	7 - 75	0 - 70	13 - 79	6 - 64	4 - 52	0 - 47	3 - 40	2 - 49	0 - 60	1 - 65	0 - 74
	Average	41	45	36	43	36	27	21	20	26	23	34	33

The state and federal 8-hr O_3 standards are $157 \mu\text{g}/\text{m}^3$

Table 4-18 Monthly Summary of 1-Hour Hydrogen Sulfide ($\mu\text{g}/\text{m}^3$)

(The month with the highest annual value is highlighted)

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Lava Tree	Range	3 - 4	3 - 4	3 - 4	3 - 4	0 - 4	3 - 4	3 - 6	3 - 4	3 - 4	3 - 6	1 - 13	4 - 10
	Average	3	3	3	3	3	4	3	3	3	4	4	4
Puna E	Range	1 - 6	0 - 4	0 - 3	0 - 7	1 - 6	1 - 6	1 - 4	1 - 4	3 - 6	3 - 6	3 - 6	3 - 6
	Average	3	2	1	2	2	3	3	3	4	4	4	4
Puna H	Range	0 - 7	0 - 4	1 - 4	0 - 4	1 - 6	1 - 4	1 - 4	3 - 4	3 - 7	0 - 7	0 - 3	0 - 3
	Average	1	2	2	3	2	2	3	3	3	3	0	1

The state H_2S standard is $35 \mu\text{g}/\text{m}^3$, there is no federal ambient air standard for H_2S

Table 4-19 Monthly Summary of 3-Hour Sulfur Dioxide ($\mu\text{g}/\text{m}^3$)

(The month with the highest annual value is highlighted)

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	0 – 24	0 - 20	0 - 67	0 - 14	0 - 4	0 - 16	0 - 3	0 - 6	0 - 3	0 - 12	0 - 50	0 - 21
	Average	4	0	2	0	1	2	1	2	3	1	1	0
Makaiwa	Range	0 – 70	0 - 23	0 - 40	1 - 23	0 - 28	0 - 35	2 - 91	0 - 19	0 - 29	0 - 45	0 - 27	0 - 24
	Average	5	3	4	3	4	4	3	2	1	3	1	2
Kapolei	Range	0 – 26	0 - 2	0 - 3	0 - 8	0 - 10	0 - 3	0 - 3	0 - 3	0 - 9	0 - 12	0 - 5	0 - 5
	Average	1	0	0	1	2	1	1	0	1	1	0	0
West Beach	Range	0 – 16	0 - 3	0 - 5	0 - 3	0 - 6	0 - 4	0 - 3	0 - 3	0 - 3	0 - 3	0 - 3	0 - 3
	Average	0	0	0	0	0	1	0	0	0	0	0	0
Kona	Range	3 – 91	5 - 50	2 - 37	4 - 30	5 - 30	7 - 57	3 - 29	5 - 20	5 - 32	5 - 20	5 - 20	5 - 20
	Average	11	11	9	10	11	12	9	7	8	8	8	9
Hilo	Range	3 – 574	2 - 116	3 - 318	0 - 27	0 - 44	0 - 33	0 - 50	0 - 97	0 - 188	0 - 425	0 - 116	0 - 170
	Average	29	6	17	4	2	1	1	1	5	19	3	7

The state and federal 3-hr SO_2 standards are $1300 \mu\text{g}/\text{m}^3$

Table 4-20 Monthly Summary of 24-Hour Sulfur Dioxide ($\mu\text{g}/\text{m}^3$)

(The month with the highest annual value is highlighted)

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	0 - 14	0 - 6	0 - 17	0 - 4	0 - 2	0 - 6	0 - 2	1 - 3	2 - 3	0 - 2	0 - 16	0 - 6
	Average	4	0	2	0	1	2	1	2	3	0	1	0
Makaiwa	Range	1 - 18	1 - 7	1 - 10	2 - 6	0 - 7	3 - 9	3 - 16	0 - 6	0 - 5	0 - 14	0 - 4	0 - 7
	Average	5	3	4	3	4	4	3	2	1	3	1	2
Kapolei	Range	0 - 7	0 - 1	0 - 2	0 - 3	0 - 9	0 - 3	0 - 3	0 - 1	0 - 2	0 - 3	0 - 1	0 - 1
	Average	1	0	0	1	2	1	1	0	1	1	0	0
West Beach	Range	0 - 4	0 - 1	0 - 1	0 - 1	0 - 2	0 - 3	0 - 2	0 - 1	0 - 0	0 - 1	0 - 1	0 - 0
	Average	1	0	0	0	0	1	0	0	0	0	0	0
Kona	Range	3 - 39	7 - 18	4 - 16	7 - 15	8 - 17	8 - 21	4 - 16	5 - 12	5 - 14	5 - 13	5 - 12	7 - 13
	Average	11	11	9	10	11	12	9	7	8	8	8	9
Hilo	Range	3 - 104	3 - 45	3 - 112	1 - 8	1 - 12	0 - 6	0 - 9	0 - 16	0 - 42	0 - 87	0 - 33	0 - 41
	Average	29	6	17	4	2	1	1	1	5	19	3	7

The state and federal 24-hr SO_2 standards are $365 \mu\text{g}/\text{m}^3$

Section 5

AMBIENT AIR QUALITY TRENDS



Puna H station

The following graphs illustrate 5-year trends for SLAMS and NAMS stations monitoring for PM₁₀, ozone, carbon monoxide, sulfur dioxide, and nitrogen dioxide from 1999 to 2003.

The graphs for PM₁₀, sulfur dioxide and nitrogen dioxide (figures 5-1, 5-5 and 5-6, respectively) represent the annual averages for each year and for each station that monitors for that pollutant. Annual averages are derived by calculating the arithmetic mean of all valid hours recorded in the year. Included in the graphs are the state and federal annual standard(s).

The graphs for 1-hour ozone, 1-hour carbon monoxide, and 8-hour carbon monoxide (figures 5-2, 5-3 and 5-4, respectively) represent the average of the daily maximum 1-hour or 8-hour values recorded in the year. These values are obtained by taking the highest recorded 1-hour or 8-hour value for each day then calculating the arithmetic mean of all those hours to arrive at the annual maximum average. Ozone and carbon monoxide do not have state or federal annual standards, however, included in the graphs are the 1-hour and 8-hour standards.

Air quality in the State of Hawaii continues to be one of the best in the nation, and criteria pollutant levels remain well below federal ambient air quality standards.

Figure 5-1 PM₁₀ Annual Average 1999 - 2003

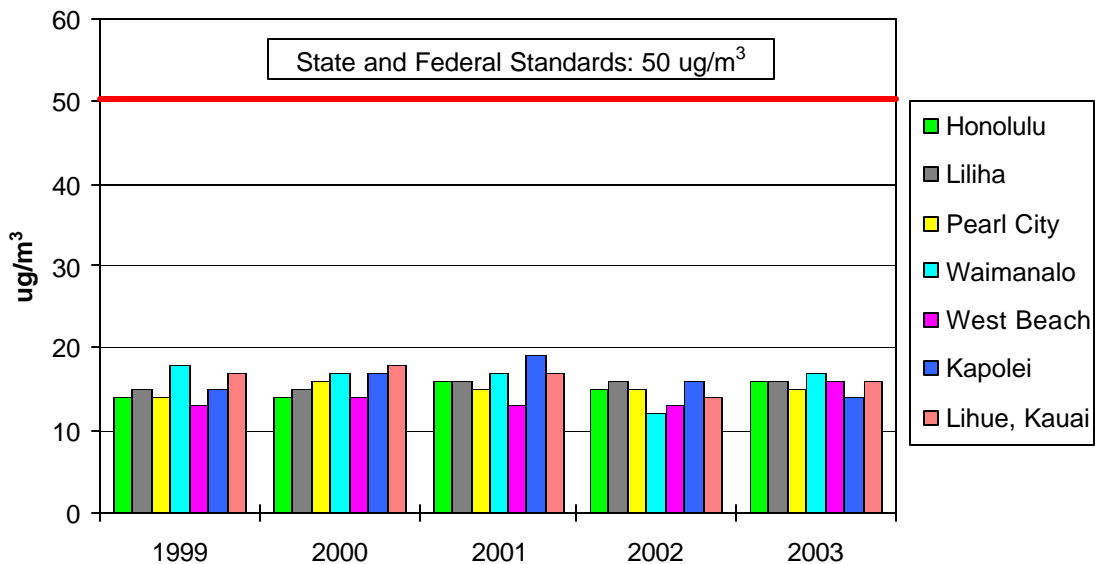
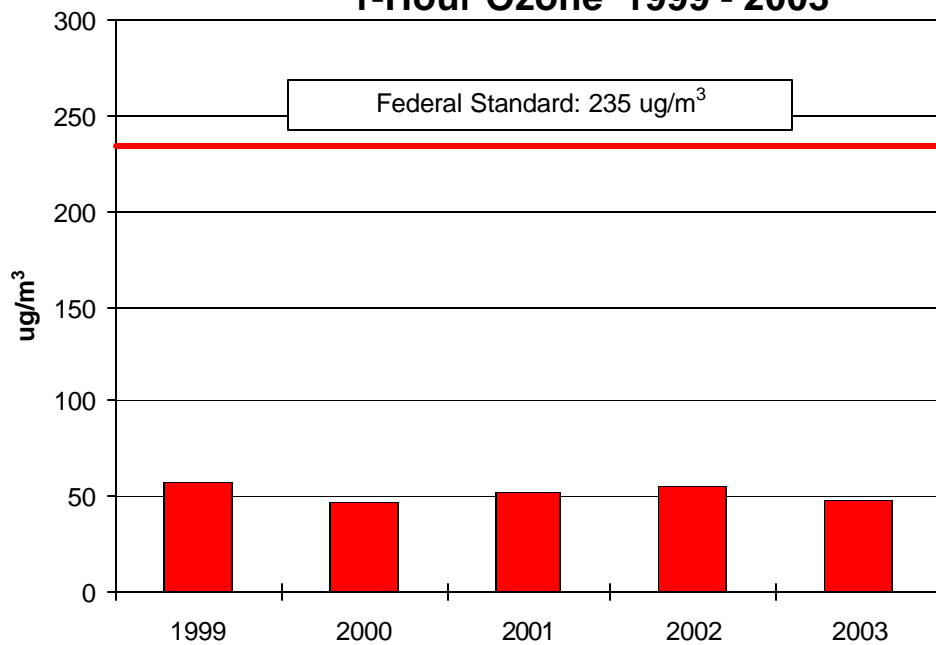
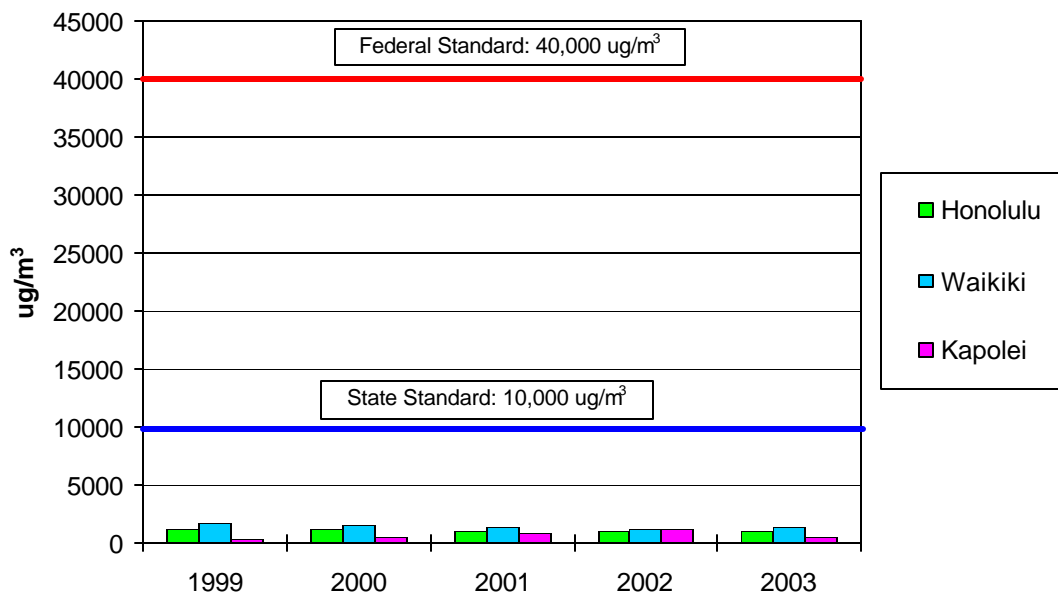


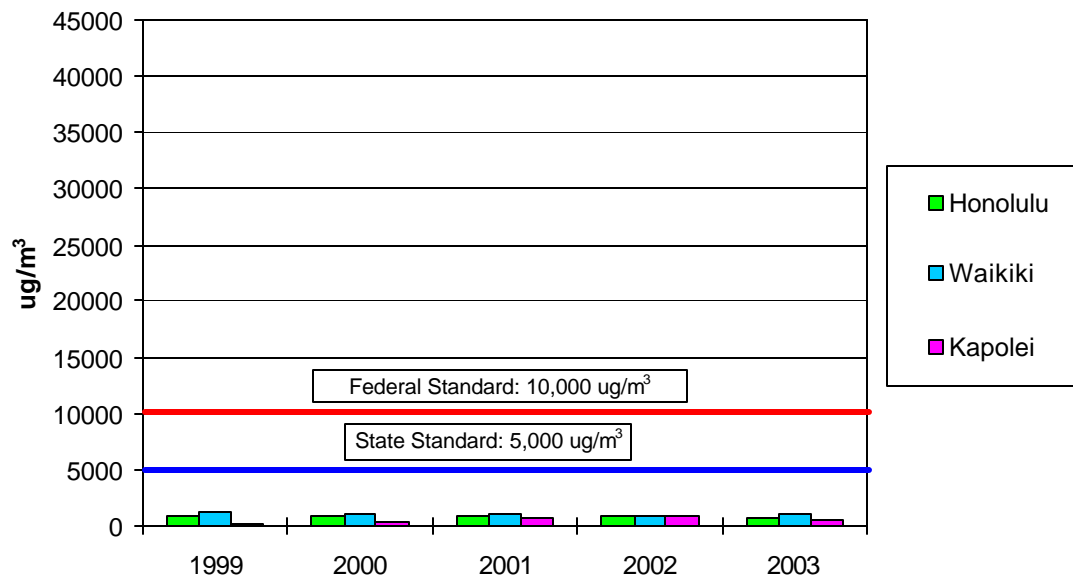
Figure 5-2 Annual Average of Daily Maximum 1-Hour Ozone 1999 - 2003



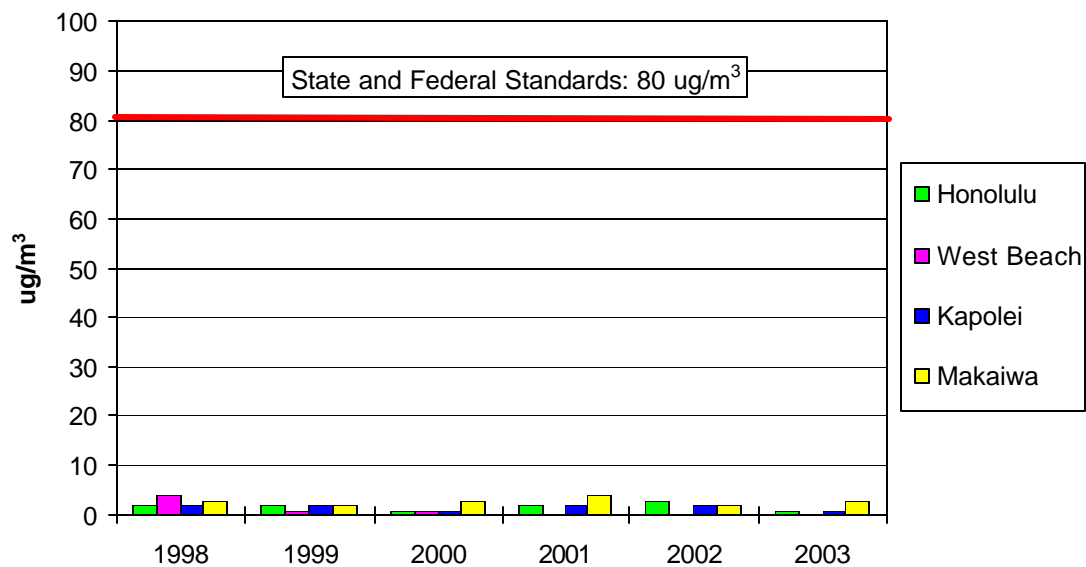
**Figure 5-3 Annual Average of Daily Maximum
1-Hour Carbon Monoxide
1999 - 2003**



**Figure 5-4 Annual Average of Daily Maximum
8-Hour Carbon Monoxide
1999 - 2003**



**Figure 5-5 Sulfur Dioxide Annual Average
1999 - 2003**



**Figure 5-6 Nitrogen Dioxide Annual Average
1999 - 2003**

